

TWO NEW SPECIES OF PLECOPTERA FROM VICTORIA.

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INTRODUCTION.

1802. PERLARIAE. Latr. Hist. Nat. 3, 292.

1839. PLECOPTERA. Burm. Handb. Ent. 2, 863.

P. W. Claassen suggests in his "Catalogue of the Plecoptera of the World" in Cornell Univ. Agr. Exp. Sta. Memoir 232, 1940, p. 19, 'It seems advisable to retain the more generally used term *Plecoptera* for this Order.'

Order PLECOPTERA.

Family *Eusthenidae*.

Subfamily *Eustheninae*.

The description of *Thaumatoperla robusta* by the late Dr. R. J. Tillyard, in the Proceedings of the Linnæan Society of New South Wales, Vol. 46, 1921, brought to light the existence of a very archaic type of Stone fly, which in fact, could be regarded as a true *Protoperlarian*.

Few specimens only of *T. robusta* exist in collections; the holotype female is in the National Museum collection, Melbourne, together with another female; the allotype male is in the Cawthron Institute collection at Nelson, New Zealand. Both type specimens were collected near Warburton, Victoria, the other female specimen in the National Museum collection being labelled "Millgrove, Victoria; T. H. Tregellas." The description of the allotype male is given (Tillyard) in the Proceedings of the Royal Society of South Australia, vol. 48, 1924.

With this description, Tillyard mentions, "A half-grown larva of this fine species has recently been taken by Mr. F. Erasmus Wilson, in a mountain stream near Mt. Ben Cairn, Millgrove, Victoria; where both male and female specimens of this rare insect have been found by Mr. Wilson and Mr. Charles Barrett. The larva is black, with the thoracic sterna, sutures, and coxae, yellow; the femora tinged with olive-green beneath. A similar larva, full fed, and of great size (about 45 mm. long) was taken by

me on Mt. Kosciusko, New South Wales, in November, 1921. The underside had the yellow colouration replaced by brick red. Thus we may conclude that either *T. robusta* itself, or a related, undescribed species is to be found on Mt. Kosciusko."

It is very likely that this larva just referred to may prove to be the larva of *Thaumatoperla alpina* sp. n., one of the two new species hereunder described:—

Thaumatoperla alpina sp. n.

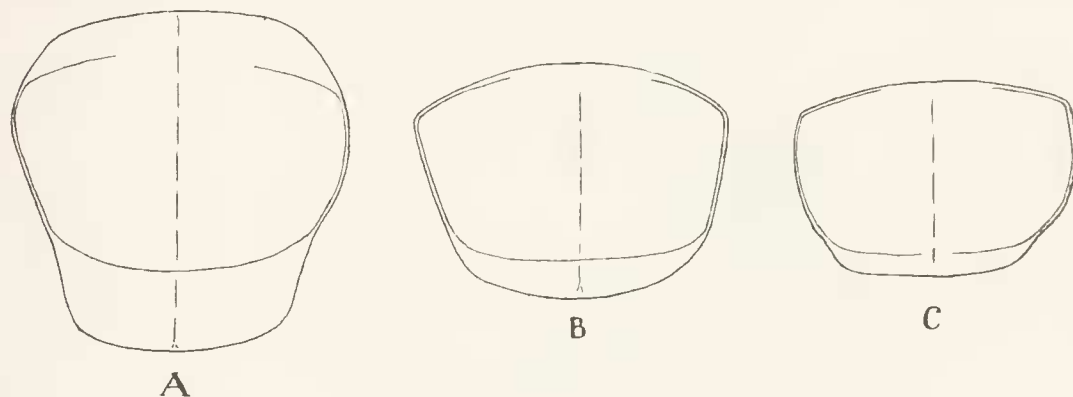
Female, length of body (including head), fresh specimens 36–44 mm.

Anterior wing, length 20–22 mm.; width, 9.5–11.0 mm. Expanse (across). 42–51 mm.

Posterior wing, length, 18–20 mm.; width, 16–18 mm.

Head, black with a greyish spot on each side of the frontal suture just inwards from the base of the antennae.

Eyes, dark olive-grey; *Labrum*, black; *Labium*, brownish-black; *Mandibles* and *Maxillae*, dull-black; *Genae*, dull-black; *Antennae*, black, 54–63 segments, length, 23–26 mm.



A. *Thaumatoperla alpina* sp. n. outline of prothorax.

B. *Thaumatoperla robusta* Till, outline of prothorax.

C. *Thaumatoperla flaveola* sp. n., outline of prothorax.

Thorax. Prothorax, length, 8–9 mm.; width, 8–9 mm. Cinnamon rufous (Ridgeway), darkest along anterior ridge which is continued along the sides and just behind the central black marking. A short median ridge connects the posterior margin of the prothorax with the encircling ridge. Central marking black, shiny, almost oval in shape.

Mesothorax, black, with anterior margin yellowish-orange, narrowed at centre.

Metathorax, black with a fine pale yellowish posterior margin. In the dried specimen the yellowish markings are less intense.

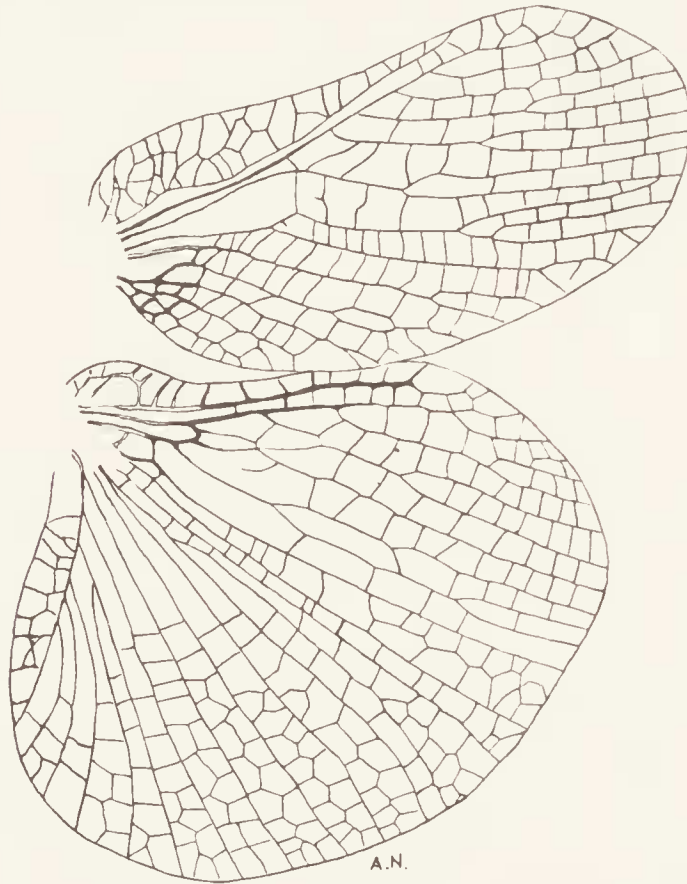
Legs, including tarsi, uniformly black. *Anterior wings*, aniline black, dull, (Ridgeway), *Posterior wings*, black, with dark-blue iridescence.

Abdomen, cylindrical, somewhat flattened dorsally, pale yellowish-grey; ninth and tenth segments recurved forwards; ninth segment black with median dorsal area and posterior margin narrowly yellowish-grey; tenth segment black. *Cerci*, black, with 34–35 segments, length 20–24 mm.

Ventral surface. Prothorax, cinnamon rufous (Ridgeway), between first pair of legs a large black area with a dark-brown longitudinal central band extending from the centre to the hind margin of the black area.

Mesothorax, dull pinkish-yellow with a blackish area between the second pair of legs to about half way to hind margin, and extending round insertions of coxae.

Abdomen, yellowish-grey with dull blackish lateral markings; ninth and tenth segments dull black; ninth segment with a slight median carina on each side of which is a centrally placed tubercle.



Wings: *Thaumatoperla alpina* sp. nov.

The first specimen was brought alive to the National Museum, and was found to be carrying a large mass of eggs which was placed as follows:—The ninth and tenth abdominal segments, including the cerci, were recurved forwards dorsally over the abdomen. The eggs were then actually placed on the ventral surface of the ninth and tenth segments, and held from the top by the cerci. The total number of eggs was found to be 1,029, and each egg measured 1 x .65 mm. These were carefully placed in water in which they quickly separated out from the mass and settled down individually. After separation, each egg gradually became enclosed within a translucent gelatinous capsule.

Locality, Holotype, Mt. Fainter, Victoria, at between 4,000 and 5,000 feet. April 18th, 1954. Female specimen collected by Mr. J. Brownlie of Elsternwick, Melbourne. This specimen was taken resting on a stump approximately 50 yards distant from the nearest running water.

Paratypes, two females, Mt. Bogong district, Victoria, 4,000 ft. March 16th, 1957, collected by Miss H. Purnel and Mr. A. J. McComb.

Type, HOLOTYPE and PARATYPE females in Coll. National Museum of Victoria.

Thaumatoperla flaveola sp. n.

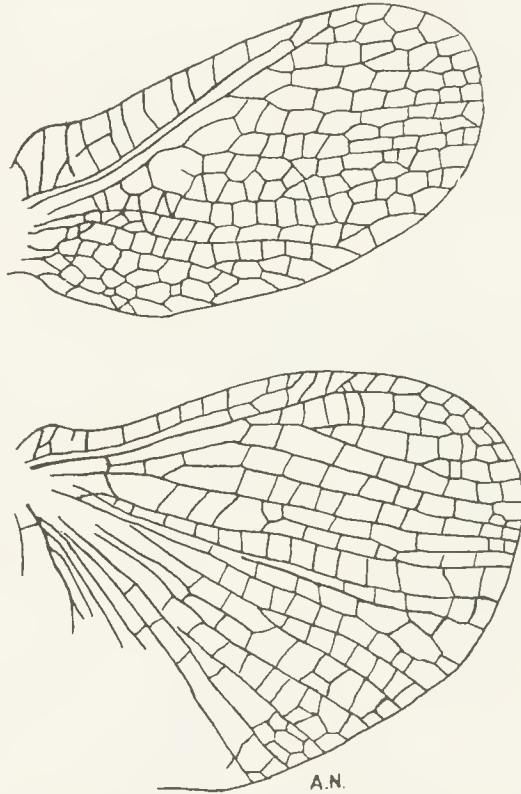
Male, length of body (including head), dried specimen, 23 mm.

Anterior wing, length, 16 mm.; width, 7 mm. Expanse (across) 36 mm.

Posterior wing, length, 16 mm.; width, 13 mm.

Head, reddish-brown with large brownish-black area in front.

Eyes, black; *Labrum*, black; *Labium*, black, lighter towards base; *Mandibles* and *Maxillae*, black; *Genae*, black; *Antennae*, black, 58 segments, length (approx.) 17 mm.



Wings: *Thaumatoperla flaveola* sp. nov.

Thorax. *Prothorax*, length, 4.5 mm.; width, 6.7 mm. Sudan brown (Ridgeway), shiny, sculptured, prominent encircling ridge, posterior margin black.

Mesothorax, black, shiny, strongly ridged posteriorly. Base of anterior wings dark-brown.

Metathorax, black, anterior portion dark-brown.

Legs, *Coxae*, dark-brown; *Femora*, dark yellowish brown; *Tibiae*, black; *Tarsi*, black. *Anterior wings*, tawny-olive (Ridgeway) with greyish-brown mottlings in central area and reaching hind margin. *Posterior wings*, deep neutral-grey (Ridgeway), costa and apex tawny-olive (Ridgeway).

Abdomen, cylindrical, flattened dorsally, shining black, ninth segment dark-brown, tenth segment black; these two segments curved upwards. *Cerci*, black, with 28 segments, length (approx.) 15 mm.

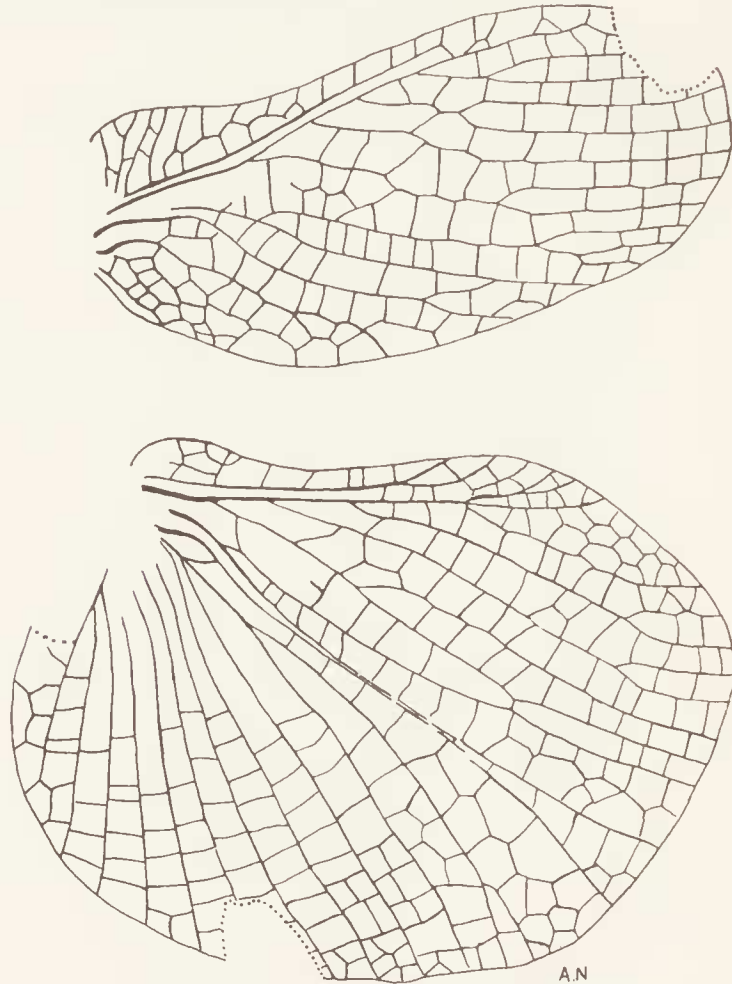
Ventral surface. Prothorax, yellowish-brown, edges of coxal sutures dark-brown.

Mesothorax, dark-brown, edges of coxal sutures almost black.

Metathorax, black, eighth and ninth segments with short brown pubescence.

Locality, this specimen was captured at The Waterfall, Mt. Buller-road, Victoria, on 14th March, 1954, by Mr. F. E. Wilson.

Type, HOLOTYPE male in Coll. F. E. Wilson.



Wings: *Thaumatoperla robusta* Till. A.N

Thaumatoperla robusta Till.

We give here Tillyard's description of this species, and add to it some further data. The female was described in Proc. Linn. Soc. N.S.W., 1921, vol. 46, p. 226; and the male in Trans. roy. Soc. S. Aust., 1924, vol. 48, p. 192.

Female, "total length, 29 mm.; abdomen (dried), 17 mm.; forewing, 22 mm., hindwing, 20.5 mm., expanse, 47 mm.

Head, shiny black above, with a small yellowish spot on each side of the frontal suture, just below and inwards from the base of the antennae, a transverse narrow band of olive-greenish on the labrum, and a slight touch of

yellowish-brown on mandibles and maxillae; *genae* orange-brown; *labium*, dull-brownish. *Eyes*, dark olive-grey. *Antennae* 17 mm. long, black, composed of 50 or more joints.

Thorax. *Pronotum*, rich orange, the convex anterior border somewhat darkened; length of pronotum, 4.5 mm., breadth, 7.5 mm., the latter greatest anteriorly; *prosternum*, yellowish-grey. *Meso* and *metathorax*, black, with a band of pale-brown between the bases of the forewings; this colour extends on to the basal dilated portion of the costal space of the forewings, and carries golden hairs on both the thorax and wings. *Legs*, black, the fore femora pale-brown on anterior border and part of the underside; the middle and hind femora with these same parts coloured more greyish-yellow. *Wings*, uniformly dull-blackish, except for the small patch of pale brown at base of costal space of forewings, already mentioned.

Abdomen, broad, nearly cylindrical, somewhat flattened, black.

Cerci (apparently with some distal joints missing), with fifteen or more short joints, the basal ones shorter than the more distal, and all carrying cilia; colour black."

Male, 'hitherto undescribed, differs from female as follows:—Total length of body 19 mm.; *forewing*, 18 mm.; *cerci*, 18 mm. The parts of the meso and metathorax, coxae, and femora, which were described as either brown or greyish-yellow in the female, are bright yellow in the male. Segment No. 9 hollowed out posteriorly above, broadly yellow on either side. Tenth tergite narrowly yellow. Supra-anal plate with a forwardly curved copulatory hook, rather short; paraprocts short, blunt.'

We desire to confirm, and add the following:—Measurements of *Prothorax*, width, 7.5 mm.; length, 5.5 mm. The latter dimension disagrees with Tillyard's who gives it (length) as 4.5 mm. Evidently he omitted to include the posterior margin beyond the ridge. For better comparison of *T. robusta* with *T. alpina* and *T. flaveola*, we give the colours from Ridgeway, as follows:—*Prothorax*, burnt sienna; *meso-thorax*, black, with a band of cinnamon buff. Anterior wings, bister, dull. *Posterior wings*, warm sepia, shiny.

R. J. Tillyard in his "Revision of the Family Eusthenidae", Proc. Linn. Soc., N.S.W., 1921, vol. 46, p. 224, forms three new subfamilies within it, giving the following key:—

1. Wings very short and broad, the forewing less than twice as long as broad; M5 in forewing very strongly formed, making an acute angle with M1-4 distally. Costa of forewing strongly dilated basally. Branches of Rs arising from R as a pectinate series of apparently separate sectors *Thaumatoperlinae*.
- Wings not exceptionally short or broad, the forewing always more than twice as long as broad. M5 less strongly formed, making neither a right angle nor an obtuse angle with M1-4 distally. Costa of forewing not dilated basally. Branches of Rs in forewing dichotomic, arising normally from Rs. 2
2. Stoutly built insects of red or purple colouration, the forewing less than thrice as long as broad. *Cerci* long, from 12 to 16 mm. *Eustheninae*.

Much more slenderly built insects of green, yellow, brown, or grey colouration, the forewing about five times as long as broad. *Cerci* short, from 5 to 8 mm. *Stenoperlinae*.

None of the later papers accepts the formation of these subfamilies; Tillyard himself in his paper "New Genera and Species of Australian Stoneflies" (Order Perlaria), in Trans. roy. Soc. S. Aust., 1924, vol. 48, p. 129, and, in his 'Insects of Australia and New Zealand', 1926, pp. 116-119, makes no further mention of the above subfamilies.

P. W. Claassen in "A Catalogue of the Plecoptera of the World", Cornell Univ. Agr. Exp. Sta. Memoir 232, 1940, pp. 19-21, does not accept or even mention any of the subfamilies cited by Tillyard in the family *Eusthenidae*.

W. E. Ricker, Indiana University, in his paper, "Some Evolutionary Trends in Plecoptera", Proc. Indiana Acad. Sci. 1950, vol. 59, recognizes in his table of Structural Evolution, only the subfamily *Eustheninae* for Australia and New Zealand.

The authors of this paper prefer using the family *Eusthenidae* with its two subfamilies as used by Ricker (1950), who based his separation on the characters of simple gills for larvae of *Eustheninae*, and branched ones for larvae of *Diamphipnoinae*.

In our opinion, the genera in the Australian region probably belong to one continuous group, and it is difficult to find a reason for further separation into subfamilies unless later discoveries or complete life histories of these insects are studied which may give justification for separation.

Undoubtedly the genera *Thaumatoperla* Till. and *Eusthenopsis* Till. are very closely related, but *Eusthenia* West, occupies an intermediate position between them and *Stenoperla* McLach.

Key to the Species of *Thaumatoperla*.

1. Head not as wide as Prothorax; width of Prothorax equal to its length *alpina*, sp. n.
 Head as wide as Prothorax, width of Prothorax greater than length 2
2. Anterior wings unicolorous, except for base of costal space. Posterior wings unicolorous *robusta*, Till.
 Anterior wings not unicolorous; posterior wings not unicolorous *flaveola* sp. n.

As stated by Tillyard and other authors, the family *Eusthenidae* represents present-day forms of an archaic type of Stoneflies which showed affinities with the *Protoperlaria*. The characters which denote its linkage with archaic forms may be summarized as follows:—The larvae possessing five or six pairs of lateral abdominal gills; the extensive but somewhat irregular wing venation in the adults, and this affinity with the wing tracheation exhibited by the larvae. The presence of mandibulate mouth parts in the adult, and possession of a well-developed clypeus and labrum. Both pairs of wings exhibit a large number of cross veins, and in the posterior wings the anal fan is very large.

The genus *Thaumatoperla* presents extensive but somewhat irregular wing venation with a great number of small cross veins which are variable and irregular in individual wings, showing primitiveness. The extreme hind margin of the posterior wings is divided into numerous small cells, as is also the costal region of the anterior wings.

Recognizing these primitive characters, and applying them to the three species of *Thaumatoperla*, we have arrived at the following conclusions:—

1. *T. alpina* is the most archaic; this is indicated by the form of the Prothorax (width equal to length); greatest number of small cells in costal region of the anterior wings, and extreme hind margin of the posterior wings.
2. *T. robusta* becomes intermediate in position; the Prothorax is distinctly broader than long, the number of small cells in the costal region of the anterior wings is reduced as is also the case for the extreme hind margin of the posterior wings.
3. *T. flaveola* may be regarded as the least primitive of the three species. A slightly greater reduction in length of the Prothorax as compared with its width is evident; the costal region of the anterior wings shows fewer cross veins. The same applies to the extreme hind margin of the posterior wings where only a few short veins connect the last anal vein with the hind margin.

ACKNOWLEDGMENTS.

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REFERENCES.

1921. Tillyard, R. J., Revision of the family *Eusthenidae* (order Perlaria) with descriptions of New Genera and Species. Proc. Linn. Soc. N.S.W., 46: 221-236.
1924. Tillyard, R. J., New Genera and Species of Australian Stoneflies (order Perlaria), Trans. roy. Soc. S. Aust., 48: 192-195.
1926. Tillyard, R. J., The Insects of Australia and New Zealand. Angus and Robertson Ltd., Sydney.
1940. Claassen, P. W., A Catalogue of the Plecoptera of the World. Cornell Univ. Agr. Exp. Sta. Memoir 232.
1950. Ricker, W. E., Some Evolutionary Trends in Plecoptera. Proc. Ind. Acad. Sci. 59: 197-209.



1. *Thaumatoperla robusta* Till. Female.
2. *Thaumatoperla alpina* sp. nov. Female. (Holotype).
3. *Thaumatoperla faveola* sp. nov. Male. (Holotype).